ORDER

6790.13A

VERY HIGH FREQUENCY OMNIDIRECTIONAL RANG-E TEST (VOT)
PROJECT' IMPLEMENTATION PLAN (PIP)

May 23, 1991

DEPARTMEN'T OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Distribution: A-W(NN/SM)-3; A-X(AF)-3;A-Z(CN)-3; A-Y(DE/AY)-3

Initiated By: ANN-130

FOREWORD

This order provides direction for the implementation and acceptance of the Very High Frequency Omnidirectional Range Test (VOT). This order defines the functional responsibility levels, management direction, and overall program guidance to all responsible levels within the FAA for the implementation and installation of the VOT.

Charles B. Ochoa
Program Manager for Navigation

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CHAPTER 1. GENERAL

1. PURPOSE. This order provides program management direction and guidelines for the Very High Frequency Omnidirectional Range Test (VOT) Facility System.

2. DISTRIBUTION. This order is distributed to branch level in the office of the Program Director for Navigation and Landing and the Systems Maintenance Service; to branch level in the regional Airway Facilities divisions; to branch level in the Communications/Navigation/Surveillance Division at the FAA Technical Center; and to branch level in the FAA Logistics Center, and the FAA Academy at the Mike Monroney Aeronautical Center.

3. CANCELLATION. Order 6790.13, Very High Frequency Omnidirectional Range Test (VOT) System Program Plan (SPP) and System Implementation Plan (SIP), dated March 10, 1987, is canceled.

4. DEFINITIONS. Refer to Appendix 4 for definitions and acronym list.

5. AUTHORITY TO CHANGE THIS ORDER. This order is issued under the authority of the Program Manager for Navigation, ANN-300. Any changes, revisions, or cancellation of this order may only be approved by ANN-300.

6.-9. RESERVED.

CHAPTER 2. PROJECT OVERVIEW

20. SYNOPSIS. The VOT generates a nondirectional, horizontally polarized field pattern in the 108 to 118 Megahertz (MHz) band. This pattern is simultaneously modulated by two in-phase audio signals that duplicate the very-high-frequency omnidirectional range (VOR) reference and variable signals. When the VOT signal is demodulated in the aircraft receiver, the two in-phase signals will produce the same reading on the course deviation indicator (CDI) as though the aircraft receiver were located at magnetic north (0 degrees) from the VOT. When tuned to the VOT station frequency, the aircraft VOR receiver should indicate zero degrees 'FROM' irrespective of the aircraft position with respect to the VOT.

21. PURPOSE. The procurement of VOT equipment is necessary to provide VOT equipment for establishing new facilities and replacing existing obsolete equipment. The new facilities are needed to provide VOR receiver operational test capability to airports that do not have this service or to replace existing systems that are more than 25 years old. The FAA Logistics Center no longer has support/sparing capability for the existing systems.

22. HISTORY.

a. The VOT transmits a signal that provides a convenient and accurate standard for checking the operational status of standard VOR receivers within the VOT facility use areas. The normal use areas include ramps, taxiways, intersections, other airport locations, and areas outside the airport where VOT signal strength allows such checks.

b. The present VOT facilities use tube-type equipment that is. at least 25 years old. This equipment will not meet future FAA requirements for VOT facilities because existing equipment requires excessive maintenance and requires spare parts which are no longer available.

c. VOT facilities require improved performance, reliability, and maintainability. This new VOT will incorporate modular design, solid state electronic components, and digital signal generation to provide a very reliable facility that can be easily maintained.

23.-29. RESERVED.

CHAPTER 3. PROJECT DESCRIPTION

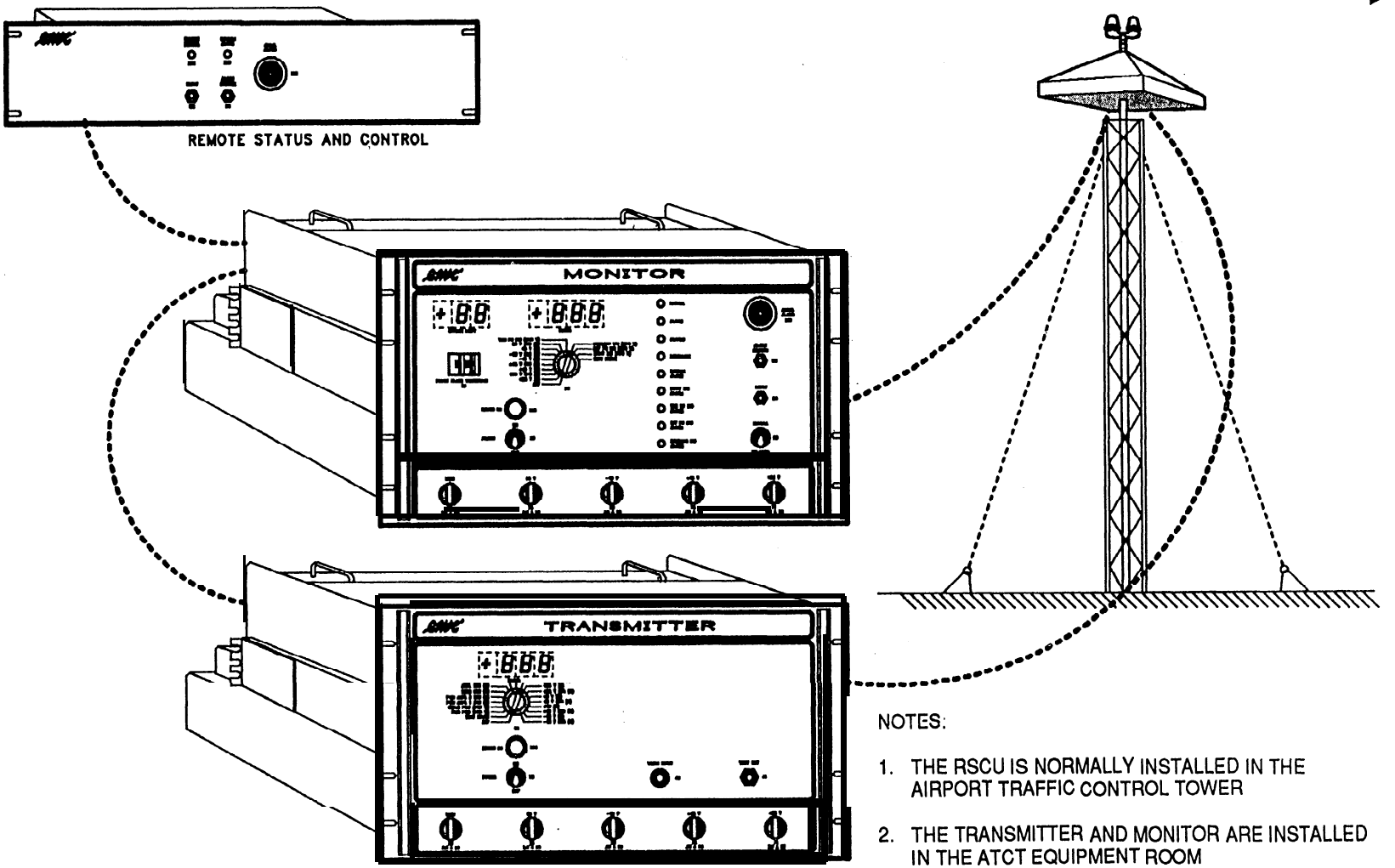
30. FUNCTIONAL DESCRIPTION. Refer to Figure 3-1, VOT Relationship of Units, in conjunction with the following subparagraphs. The transmitter and monitor with their power supplies are rack mounted on rails in standard 19-inch width cabinets, one above the other, and interconnected with the interface cable assembly (part of the cable kit). The antenna is typically located on top of the building shelter and protected by a fiberglass radome. A 50 Ohm coaxial feeder cable (not supplied) connects transmitter output to antenna input. An integral monitoring loop on the stripline antenna monitors antenna radiation and feeds modulation signals to the monitor in the equipment cabinet via a 50 Ohm coaxial cable (not supplied). The remote status and control unit (RSCU) (typically located away from the transmitter/monitor cabinet) is connected to the monitor via five twisted-pair cable (not supplied).

a. Transmitter. All modulating signals originate in the transmitter. The assigned channel frequency is generated by a crystal-controlled oscillator and is modulated by course signals and ident signals. Speech signals, if required, can be input from a remote location via 600 Ohm speech and control lines, or they can be input locally by a handset connected at the transmitter front panel. Simultaneous speech/ident modulation or non-simultaneous speech/ident modulation can be selected as required. The radiofrequency (RF) carrier is amplified to a nominal 2.5 Watts (W) and fed via 50 Ohm cable to the antenna for omni-directional radiation. An RF attenuator at the output of the transmitter attenuates the RF power output up to 15 decibels (dB) in 1 dB increments.

b. Monitor. The monitor loop return cable from the antenna feeds four signal samples to the monitor: ident, variable phase, reference phase, and subcarrier. Signal levels are continuously sampled and checked. If any signal level is out-of-tolerance, an alarm is generated and the applicable front panel alarm light emitting diode (LED) and aural alarm are enabled. When an alarm is activated, the monitor shuts down the transmitter unless the system is in bypass mode (only used for maintenance).

c. RSCU. The five twisted-pair wires connecting the RSCU to the monitor carry two LED-enabling signals from the RSCU to the monitor. When the VOT system is operating within tolerance, the monitor enables the SYSTEM NORMAL indicator LED on the RSCU panel. When any alarm on the monitor panel is enabled, the monitor also generates alarm signals to enable the SYSTEM ALARM indicator LED and the aural alarm on the RSCU. The aural alarm signal can be silenced and the VOT monitor can be manually reset via pushbutton switches on the RSCU front panel.

FIGURE 3-1. VOT RELATIONSHIP OF UNITS



NOTES:

1. THE RSCU IS NORMALLY INSTALLED IN THE AIRPORT TRAFFIC CONTROL TOWER
2. THE TRANSMITTER AND MONITOR ARE INSTALLED IN THE ATCT EQUIPMENT ROOM
3. THE ANTENNA IS NORMALLY INSTALLED ON THE AIRPORT TRAFFIC CONTROL TOWER

3 1. PHYSICAL DESCRIPTION.

a. VOT System. The equipment consists of the four units shown in Figure 3-2, VOT System Type FA-10235: transmitter, monitor, RSCU, and antenna. Interconnecting cables between the transmitter and monitor, and power cables for the transmitter and monitor, are also included in the system. Refer to Figure 3-1, which is an overview of the system showing relationships between the four units, and to Table 3-1, Physical Characteristics, which lists physical dimensions of the units.

b. Transmitter. The transmitter's chassis can be mounted in a 19-inch rack. Its front panel (10.5 in. high) contains the controls, indicators, and fuses for operation; the rear panel contains connectors for connections to other equipment. Within the chassis are two vertically mounted modules, a power supply module, and an RF attenuator module at the rear.

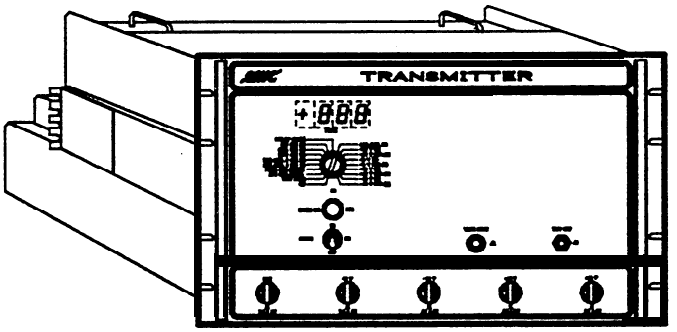
c. Monitor. The construction and dimensions of the monitor are the same as those of the transmitter. It, likewise, may be mounted in a 19-inch rack. The front panel also contains various controls, indicators, and fuses; the rear panel contains connectors for connections to other equipment., Within the chassis are two vertically mounted modules, an extender board, a power supply module, and a surge-suppression filter at the rear.

d. RSCU. The RSCU is normally mounted in the airport traffic control tower (ATCT), with the status units for the other navigational aids (NAVAID) (e.g., instrument landing system (ILS) RCSU's). Normally, this is in the equipment room. It is not intended that the VOT RSCU be located in the ATCT cab. The RSCU front panel has a nominal height of 3.5 inches and can also be mounted in a standard 19-inch rack. A chassis attached to the front of the unit protects components and provides connection points for inputs. The front panel contains alarm indicators (both visual and aural) and a reset switch for limited remote control of the VOT system. The RSCU can be located at a site remote from the transmitter/monitor where it is convenient for personnel to exercise moriitoring and limited control of the VOT system.

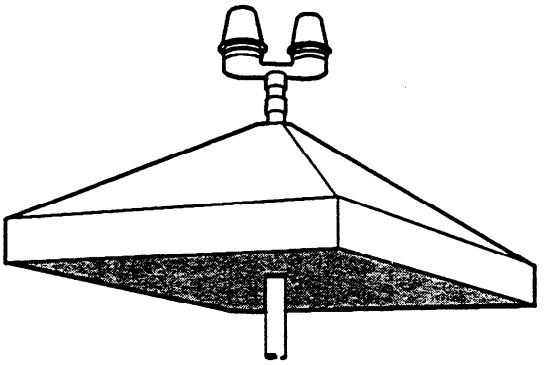
e. Antenna. The antenna consists of an omnidirectional stripline radiating device, feed and matching network, and integral monitoring loop. Antenna alignment calibration charts are also included. Antenna components are housed in a fiberglass-base plastic radome which is mounted on a 2-1/2 in. (inside diameter) supporting iron water pipe (local purchase). A threaded pipe cap for mounting obstruction lights is installed on the radome, and wiring for primary power for the lights is in place.

f. Cable Kit. Each cable kit consists of an interface cable assembly for the transmitter and monitor, and two power cables (one each for the transmitter and monitor).

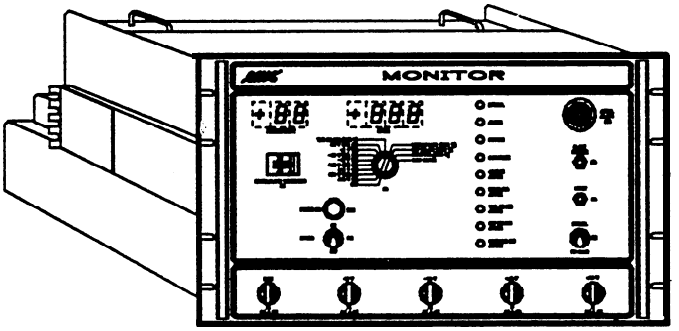
Figure 3-2. VOT SYSTEM TYPE FA-10235



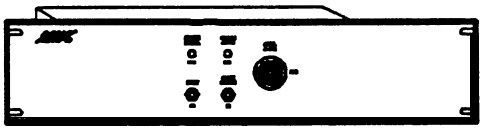
TRANSMITTER
F A 10235/1



ANTENNA
F A 10235/4



MONITOR
F A 10235/2



REMOTE STATUS
AND CONTROL UNIT
F A 10235/3

TABLE 3-1. PHYSICAL CHARACTERISTICS

	Characteristic . .	Specification
1.	Transmitter	
	Height	10.5 in.
	Width	19 in.
	Depth	20.25 in.
	Weight	61 lbs. maximum
2.	Monitor	
	Height	10.5 in.
	Width	19 in.
	Depth	20.25 in.
	Weight	54 lbs. maximum
3.	RSCU	
	Height	3.5 in.
	Width	19 in.
	Depth	2.25 in.
	Weight	2.5 lbs. maximum
4.	Antenna	
	Height of radome	12.18 in.
	Base	24.31 in. Square
	Support height	10 in.
	Obstruction light support height	3 in.
	Weight	25 lbs. maximum

32. SYSTEM REQUIREMENTS.

a. The VOT system is totally self-contained. All equipment is nominally located within or on the ATCT. The transmitter and monitor are located in the equipment room; the RSCU is collocated with the status units from other NAVAID's, and the antenna is mounted on the roof. All replaceable assemblies and adjustments are easily accessible. The VOT system may be located at an alternative facility if convenient. For example, the VOT may be located at a remote center air-to-ground (RCAG) or remote transmitter/receiver (RTR) facility with the RSCU located in the ATCT equipment room. The VOT antenna may also be sited elsewhere, within the requirements of Order 6810.2, VHF Omnirange Test (VOT) Siting Criteria. Note that the antenna coverage increases with the height above the ground plane, because it is horizontally polarized with a null at the ground plane. Therefore, it is best to site the antenna as high above the ground plane as possible.

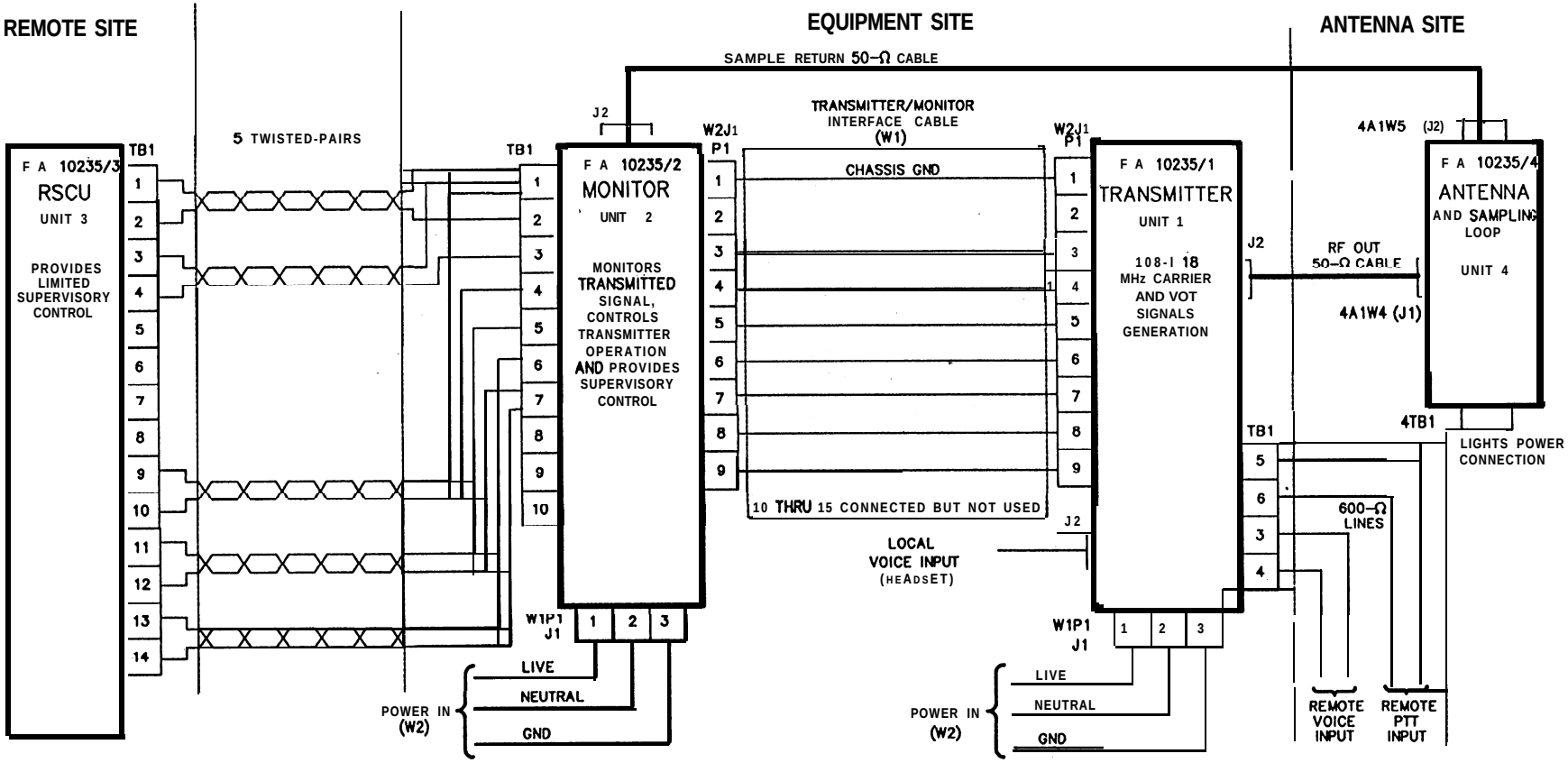
b. The VOT transmitter operates on any assigned channel between 108 and 118 MHz, with channel spacing of 50 kilohertz (kHz). The VOT signal consists of a very-high-frequency (VHF) carrier amplitude-modulated by a 30 Hertz (Hz) signal (variable phase signal) and a 9960 Hz signal frequency-modulated by a 30 Hz signal (reference phase signal) with a deviation ratio of 16: 1 (9960 ± 480 Hz). The output signal also contains a 1020 Hz signal keyed by Morse code for identification and is capable of 300 Hz to 3000 Hz voice modulation. Transmitter power output is 2 W adjustable downward 15 dB in 1 dB steps. Figure 3-3, VOT System Diagram, depicts the VOT transmitter block diagram.

c. The VOT monitor samples the radiated signal pick up from the antenna monitoring loop. If any of the monitored parameters are out of tolerance, it shuts down the VOT transmitter and indicates an alarm condition via its front panel indicators and the RSCU. The monitor has five parameter "memory lights" that report the out of tolerance condition. The monitor contains an auto-reset capability where a single reset attempt is automatically initiated by the monitor. If the reset attempt is successful, then the memory light remains lit to indicate the parameter that caused the interruption. When the technician services the equipment by placing the monitor in bypass, all memory lights are reset. Both the front panel of the monitor and the RSCU can initiate a manual reset attempt. If the manual reset attempt is unsuccessful, then the equipment remains down until serviced.

d. The VOT RSCU reports the status of the VOT monitor to a monitoring point. An aural alarm and indicator light provide an indication when the VOT system is in alarm. A remote reset button allows a single reset attempt. The alarm silence button silences the aural alarm. Note that the RSCU is connected to the VOT monitor through five pairs of 24 volt signal lines, so it cannot be remoted through commercial telephone lines.

e. The VOT antenna system contains a horizontally polarized strip line loop antenna with an integral monitor sampling loop. The antenna radiates a horizontally polarized, omnidirectional signal. A free-space-radiated sample of this signal is picked up by the sampling loop and is sent to the monitor for processing and determination of proper operating characteristics. A radome designed to withstand Environment III conditions protects the antenna system.

FIGURE 3-3. VOT SYSTEM DIAGRAM



33. INTERFACES. Alternating current (AC) power from a 115 volt, 60 Hertz, single-phase source is supplied via a standard Underwriters' Laboratories (UL) approved, three-prong, three-conductor cable. Input from the antenna probe is routed to the monitor via coaxial cable and the output from the transmitter is routed to the antenna via coaxial cable.

34.-39. RESERVED.

CHAPTER 4. PROJECT SCHEDULE AND STATUS

40. PROJECT SCHEDULE AND STATUS, GENERAL. The procurement of the VOT equipment is completed in a single contract, DTFA01-88-C-00010. This will supply equipment for 65 replacement, 36 establish, 2 test, and 9 reserve sites. System deliveries to the field will begin May 1991. Certification training by directed study with on-the-job training (OJT) (VHF Omnirange Test Facility Correspondence Study 437 16) is required.

41. MILESTONE SCHEDULE SUMMARY. A table of major project milestones is listed in Table 4-1, VOT Project Milestones. This table is not an all inclusive list of project milestones necessary for project completion.

TABLE 4-l. VOT PROJECT MILESTONES

Contract Award	29-JAN-88
System Design Review	29-APR-88
Preliminary Design Review	28-JUL-88
Critical Design Review	30-JUN-89
First System Delivered to Test & Evaluation Site	28-DEC-90
First Operational Readiness Date (ORD)	30-APR-91
Last ORD	30-JUN-92

42. INTERDEPENDENCIES AND SEQUENCE. Refer to Appendix 3, VOT Site Listing, for the interdependencies and sequence.

43.-49. RESERVED.

CHAPTER 5. PROJECT MANAGEMENT

50. PROJECT MANAGEMENT, GENERAL. The overall program management of the VOT project is the responsibility of the Program Manager for Navigation, ANN-300. The Navigation and Landing organization will accomplish management tasks within the guidelines provided by FAA policies, procedures, and directives. ANN-300 controls the schedule, funding, and matrix support. The Associate Program Manager for Engineering, Navigation Program, ANN-130 controls all technical engineering project activities. The technical officer (TO) position is filled by an engineer designated by ANN-130, and provides technical guidance and direction to the contractor within the scope of the contract. The TO is the contracting officer's technical representative (COTR) and advises the contracting officer (CO) in all technical matters. This includes approval or rejection of all contract deliverables, engineering change proposals (ECP), requests for waivers or deviations, and nonstandard parts approval requests; negotiation support to include independent cost estimates; and recommendation on payment of progress payments. The National Airspace Integrated Logistics Support (NAILS) Management Team (NAILSMT) will meet semiannually during the first few years of the contract and at least annually thereafter to address specific areas of logistic consideration and/or to review logistic requirements in general. The CO, ALG-310, designates a contract specialist to perform the general contract management activities to assure that the terms of performance under the contract are met. The CO is the only person authorized to make changes that will affect prices, deliverables, or schedules.

a. Washington, DC. The following organizations within FAA headquarters, will fulfill the indicated responsibilities required for project implementation:

(1) Program Director for Navigation and Landing (ANN).

(a) Provide technical surveillance of contractor in the design, development, testing installation, integration, and production of hardware and software for the VOT project. Ensure all technical contract requirements are met.

(b) Provide project guidance to all offices, services, centers, and regions on the implementation of the VOT project. This includes, but is not limited to:

1 Site installation.

2 Disposition of excess equipment.

3 Provisioning.

4 Updates to maintenance concept.

5 Training.

6 Configuration management.

7 Documentation deliverables.

8 All test phases.

9 ORD.

10 Operations changeover.

(c) Act as a chairman for working groups established to support the VOT project.

(d) Manage the interdependencies between the VOT project and those projects which interface with the VOT project.

(e) Coordinate the development of system shakedown test plans and procedures with the National Engineering Field Support Division, Navigation/Communications Engineering Branch, ASM-640.

(f) Act as chairman for the VOT Configuration Control Board (CCB) and Program Planning Group.

(g) Ensure the availability of funds to keep the contract within budget limitations.

(h) Determine distribution of VOT hardware documentation.

(i) Direct preparation of, and approve, all test plans, test procedures, and test reports.

(j) Act as co-chairman for the NAILSMT.

(2) System Engineering and Integration (SEI) Contractor Project Management. The SEI contractor provides technical direction in accordance with contract DTFA01-84-C-00017, Chapter 10, National Airspace System (NAS) Project Management Requirements, and in accordance with contract DTFA01-88-C-00010, par. H.3. These contracts require the SEI contractor to assist ANN-130 by fulfilling the TO role and providing assistance in the overall management of the project. Specific tasks include:

(a) Provide technical direction to the contractor in accordance with the terms of the contract.

(b) Review ECP's, waivers, and deviations.

(c) Represent ANN-130 at contractor meetings, program overview meetings (POM), and technical interchange meetings (TIM).

(d) Review contractual deliverables for COTR recommendation on approval.

(e) Coordinate project planning and scheduling with ANN-300.

(f) Configuration control the subsystem.

(g) Coordinate project funding with ANN-300.

(h) Conduct project reviews and reports.

(i) Coordinate with the VOT contractor.

(j) Provide membership to the Program Planning Group.

(k) Provide membership to the CCB.

(1) Manage and analyze integrated logistic support.

(m) Provide membership to the NAILSMT.

(3) Logistics Service (ALG).

(a) Provide support to contractor test manager for conduct of factory acceptance programs.

(b) Provide industrial engineering support and production surveillance of program management and contract administration.

(c) Provide policy and procedural guidance to regional Airways Facilities (AF) divisions and the Mike Monroney Aeronautical Center for appropriate VOT property controls prior to certification.

(d) Assist ANN in providing procedures for the disposal or utilization of surplus material.

(e) Furnish a quality reliability officer (QRO) for in-plant quality and reliability assurance.

(f) Provide a member of ALG to participate in the Project Planning Group.

(g) Provide a member of ALG to participate in the CCB.

(h) Provide membership to the NAILSMT.

(4) Systems Maintenance Service (ASM).

(a) Develop operational test and evaluation (OT&E) shakedown test plans and procedures.

(b) Develop a generic site shakedown test (or checklist) in accordance with Order 1810.4A, NAS Test and Evaluation Program, and provide this to the regional AF divisions.

(c) Provide maintenance support for hardware and diagnostic software after initial operational capability (IOC).

(d) Provide spectrum engineering support.

(5) NAS Transition and Implementation Service (ANS). The National Airspace Integrated Logistics Support (NAILS) Program Division, ANS-400, is the principal activity within the FAA responsible for assuring all applicable NAILS element requirements are managed and integrated into all new NAS subsystems, equipment and facilities in a manner which provides for total life-cycle support.

b. Field Organizations. The responsibilities of the FAA Technical Center, regions, and other field organizations include:

(1) FAA Technical Center, Engineering, Test and Evaluation Service (ACN). Provide the support necessary to test and evaluate the project for functional and operational performance and for compliance with the specification. ACN will perform these duties in accordance with Order 1810.4A. The Communications and Spectrum Branch, ACN-270, assigns a test director (TD) for the project. The TD co-authors the Master Test Plan with the program office and oversees all FAA test activities to ensure conformance with Order 1810.4A. The TD is directly responsible for OT&E integration testing. Integration testing is not required on the VOT project because the VOT does not interface with any other NAS subsystem, but OT&E will be conducted by ACN-270. The TD will coordinate his/her activities with the TO.

(2) Mike Monroney Aeronautical Center.

(a) Provide logistic support service and planning through membership to the NAILSMT.

(b) Accomplish cataloging and provisioning for VOT equipment.

(c) Provide national project material which is not procured by ALG.

(d) Monitor the development of the VOT correspondence study course as directed by the AF Training Program Division, AHT-400, and the Maintenance Operations Division, Operations Program Branch, ASM-260. Conduct VOT OJT instructor training programs to train a cadre of OJT instructors for the region.

(e) Provide for the installation and maintenance of the three VOT systems on loan to conduct OJT instructor training. Upon the completion of OJT instructor training, the three systems shall be returned to the manufacturer for refurbishment under the provisions of the contractor repair services (CRS).

(f) Provide engineering feedback to ANN- 130 for correction of system or equipment deficiencies for the installed VOT system.

(g) Provide for technical supervision of onsite activities at Mike Monroney Aeronautical Center performed under the contract.

(h) Accomplish preliminary acceptance of items delivered to the FAA Academy under the contract.

(i) Develop logistics policies and plans for support of the system, in conjunction with the NAILS Program Division, ANS-400, the Maintenance Operations Division, ASM-200, and ALG.

(j) Participate in planning activities for the transition of the system equipment into the logistics inventory.

(k) Participate, as requested by AHT-400, in the review of instruction books as part of the correspondence study materials.

(1) Assure timely selections of necessary instructor and maintenance personnel to meet Mike Monroney Aeronautical Center training and staffing requirements.

(3) Regions. Each region shall appoint a regional Facilities and Equipment (F&E) project manager (PM) for VOT. The regional PM will ensure that F&E planning is complete prior to the delivery of equipment. He/she will monitor the installation of the equipment and coordinate requests for contractual or technical support with ANN- 130 and ASM-640. Any changes in site locations for frequency assignments must be coordinated through the appropriate AF planning branch and communicated to ANN- 130. The regions shall fulfill the following responsibilities:

(a) Responsible for site preparation and monitoring equipment installation in accordance with schedules provided in Appendix 3. Coordinate with ANN on any changes to these schedules.

(b) The PM shall provide for coordination, direction, and guidance necessary for effective and timely implementation of the project. The AF divisions shall ensure that the PM is supported, as required, by AF personnel knowledgeable in the implementation of navigational systems. A Regional Integration Group (RIG) may be organized to fulfill this function. The PM/RIG is to monitor and provide assistance and guidance for all regional VOT sites.

(c) Through the NAILSMT, provide input to AAC and ANN-130 as they relate to regional logistics requirements.

(d) Conduct site shakedown tests and joint acceptance inspections (JAI) in accordance with Order 6030.45, Facility Reference Data Files.

(e) Develop the required environmental and AS BUILT records.

(f) Assure that appropriate FAA/military local onsite agreements are reached.

(g) Generate a Transition (Cutover) Plan for the replacement of existing VOT facilities, as required, in accordance with Order 6030.45.

(h) Establish financial and item management control, and accountability for all agency property received in the region.

(i) Provide proper administrative channels of communication to assure ANN-130 full cognizance of project status at all times.

(j) Spectrum Management Officer (SMO) to provide spectrum engineering support to resolve interference problems.

51. PROJECT CONTACTS. Appendix 1 contains a listing of contacts for the VOT project.

52. PROJECT COORDINATION. The following project groups will assist the program office in fulfilling assigned responsibilities.

a. Configuration Control Board (CCB). In accordance with Order 1800.8E, National Airspace System Configuration Management, dated July 11, 1985, the CCB is the official agency-authorized vehicle to approve or disapprove baselines and changes to the. baselines. There is a central NAS CCB to establish and control baselines, and to administer configuration control. From this CCB, authority is delegated to lower level CCBs to administer proposed changes effectively at the most appropriate level. All lower-level CCB's are accountable to the NAS CCB, which has been established through a charter defining its authority, responsibilities (including the specific documents over which the CCB has control), and membership.

b. Configuration Control Decision (CCD). Decisions and directions are documented in Configuration Control Decisions (CCD), which either approves, disapproves, defers, or refers the change request to another CCB. When contractual action is required, the CCD serves as a basis for preparation of any procurement request which is submitted to the CO. The CCD may also be distributed to other Government agencies and serves as an official notification of CCB action. Representatives on the CCB are to include the various agency services/offices that have responsibilities to acquire, support, and operate the system. Other representatives may be invited to attend as required.

53. PROJECT RESPONSIBILITY MATRIX.

TASK/PLAN/ACTIVITY	PRIMARY OFFICE	SUPPORTING OFFICES
Preliminary Installation Schedule	ANN-130	Regions
Training Programs Schedules and Assignments	ASM-260	AHT-400 AAC-943 Regions
Inter-facility Data Transfer Plan Update	ACN-200	AHT-400
Configuration Management(HW/SW)	ASE-600	ASM-640 Regions
Firmware Maintenance	ASM-640	Contractor
System Maintenance Procedures Handbook Update	ASM-640	Contractor
Operational Test Plan and Procedures	ACN-210	ANN-130 ASM-640
OT&E Shakedown Test Plan and Procedures	ASM-640	ANN-130 ACN-270
Transition Plan (as required) and Joint Acceptance Inspection	Regions	ANN-130 ASM-640
Logistic Support Planning	AAC, ALG	Regions
NAILS Program Management	ANS-420	AAC

54. PROJECT MANAGERIAL COMMUNICATIONS.

a. Project managerial communications are provided monthly to ANN-1 and through a Program Director Status Review (PDSR). This PDSR provides insight into cost, schedule, technical, and logistics issues that may exist. Communication to the various branches of AHT, Air Traffic Plans and Requirements Service (ATR), AAC, ALG, ASM, FAA Technical Center, the regions and other ANN organizations occurs formally through NAILSMT meetings that are initiated during all stages of the program.

b. Each region shall appoint a VOT PM as the contact point to the program office. The regional PM shall be responsible for implementation of VOT in the region.

55. IMPLEMENTATION STAFFING. The F&E workforce shall perform installations in accordance with section 9 of the technical instruction (TI) manuals.

56. PLANNING AND REPORTS. The following constitutes a list of plans, reports, source documents and orders required for the completion of the VOT project.

Plans and Reports	Responsible Office
Master Test Plan	ANN-130, ACN-270
Operational Test Plan and Report	ACN-270
OT&E Shakedown Test Plan and Report	ASM-640
Generic Site Shakedown Test Plans or Checklist	ASM-640
Transition (Cutover) Plan (as required)	Regions
Orders	
Order 6810.2, VHF Omnirange Test (VOT) Siting Criteria	ANN-130
Order 6810.1B, Maintenance of FA-10235 VHF Omnirange Test (VOT) Facility	ASM-640
Order OA P 8200.1, United States Standard Flight Inspection Manual	ACN-230
Technical Instruction Manuals	
VHF Omnirange Test (VOT) Facility; TI-68 10.1, Volumes 1 & 2	ANN-130, ASM-640

57. APPLICABLE DOCUMENTS. Appendix 2 contains a listing of documents applicable to the VOT project.

58.-59. RESERVED.

CHAPTER 6. PROJECT FUNDING

60. PROJECT FUNDING STATUS, GENERAL. The VOT project, contract number DTFA01-88-C-00010, under a lo-year NAS Plan was budgeted for $5.7 million.

a. The contract was awarded to Canadian Marconi Company (CMC) for $2.82 million on January 29, 1988. Modifications for spares, contractor repair services, and training increased to a total contract value of $3.77 million.

b. Regional Purchase Authorizations (PA) totaling $340,000 revised on February 21, 1990, provided funding for 2 hours of commissioning flight check and $500/$700 local purchase for replace/establish sites. Additional funds were provided to support the Personnel, Compensation, Benefits and Travel (PCB&T) budget line item number 8. Requests for additional funds to support special siting requirements must be coordinated through the project office.

c. PA's were provided to the Aeronautical Center to install the hot testbed and to purchase a Fluke 9100 Automated Test Equipment (ATE) test set.

d. Additional PA's were provided to the FAA Academy and the FAA Technical Center for travel and support.

e. A PA was provided to ASM-640 for $6,000 to purchase firmware support equipment.

61.-69. RESERVED.

CHAPTER 7. DEPLOYMENT

70. GENERAL DEPLOYMENT ASPECTS. Deployment will be coordinated by ANN-130.

71. SITE PREPARATION.

a. General. The VOT modernization program includes both the replacement of obsolete equipment at existing facilities and the installation of equipment at new locations. Siting requirements at specific airports vary, so installation locations are determined on a site-by-site basis. The VOT will be installed in an existing facility (e.g., airport tower, ATCT, RTR, Flight Service Station (FSS), radar facility) which complies with the system requirements (installation instructions will be provided in the VOT equipment instruction manuals). In general, VOT's which will replace existing standard VOT's can be located at the same sites and use existing hardware (including racks and antenna mounts).

b Operational Characteristics. The operational characteristics of the VOT make them inherently simple to site and install. For this reason, FAA personnel familiar with VHF equipment and antennas should have sufficient expertise to site and install the VOT. Refer to Order 6810.2 for more information.

c. General Siting Procedures. In general, VOT siting will proceed as follows:

(1) A location for the equipment and antenna will be chosen based of the general guidance provided in Order 6810.2. Site survey, installation, and checkout will be followed by a site shakedown test. A generic site shakedown test will be provided by ASM-640.

(2) The facility will be flight checked as directed in Order OA P 8200.1, United States Standard Flight Inspection Manual.

(3) If the system passes, it will undergo commissioning and JAI in accordance with Order 6030.45, otherwise it will be necessary to refer to the documents referenced in Order 6810.2 to resolve the technical problems.

d. Commissioning and Acceptance. Commissioning and acceptance procedures are in accordance with Order 6030.45, and with site shakedown procedures.

72. DELIVERY. Appendix 3 is a listing of the anticipated delivery dates. The first delivery to a sector will include an onsite spares kit.

73. INSTALLATION PLAN. Installation shall be performed by F&E personnel. Site preparation and siting will be done in accordance with Order 68 10.2. Upon completion of the site preparation, checkout and site shakedown tests will be performed. A typical installation will take approximately one to two man-days site preparation followed by one to two man-days installation and checkout. The frequency will be in accordance with Appendix 3 of the authorized frequency assignment. Installation requires a commissioning flight check. A JAI will be conducted in accordance with Order 6030.45.

74. DISPOSITION OF EQUIPMENT. The disposition of the old VOT equipment following decommissioning shall be to render the transmitter inoperable and to surplus the equipment in accordance with the Federal Property Management Regulations as described in Order 4800.2A, Utilization and Disposal of Excess and Surplus Personal Property, unless special. FAA disposal is authorized by ALG-1. If special authority is desired, assistance is available by contacting the Materiel Management Branch, ALG-220, 267-8860.

75.-79. RESERVED.

CHAPTER 8. VERIFICATION

80. FACTORY VERIFICATION. The resident QRO at the contractor's facility will ensure that factory verification is performed in accordance with the contract requirements. A Production Acceptance Test is administered to qualify each VOT system. Environmental Stress Screening (ESS) is conducted on each system as part of the acceptance test. Design Qualification Testing was completed February 9, 1990.

81. CHECKOUT. Refer to section 9 of the Technical Instruction Manuals for information pertaining to the Checkout procedures.

82. CONTRACTOR INTEGRATION TESTING. N/A

83. CONTRACTOR ACCEPTANCE INSPECTION. N/A

84. FAA INTEGRATION TESTING. Integration testing in accordance with Order 1810.4A is not required because the VOT is a stand-alone system. ACN-270 shall act as the test director in accordance with Order 18 10.4A and ensure that all operational testing issues are either incorporated at shakedown testing or separately addressed with operational test evaluations. ACN-270 will conduct an operational test concurrently with the shakedown test to coordinate testing efforts and results with ASM-640.

85. SHAKEDOWN AND CHANGEOVER. ASM-640 shall conduct a shakedown test and evaluation in accordance with Order 1810.4A. Preliminary shakedown and operational testing will be conducted by ASM-640 and ACN-270 at Mike Monroney Aeronautical Center, Hanger 9, in Oklahoma City, Oklahoma. Final shakedown and operational testing will be conducted at the first operational site in Honolulu, Hawaii. The shakedown test will evaluate the ability of regional personnel to successfully install and maintain the equipment given the training, TI manuals, and maintenance order. A site shakedown test, to be used by regional personnel to verify installation, will be validated, and a commissioning flight check and JAI will be conducted. Following a successful shakedown and operational test, a deployment recommendation will be made by both ACN-270 and ASM-640 to the Deployment Readiness Review (DRR) executive committee.

86.-89. RESERVED.

CHAPTER 9. INTEGRATED LOGISTICS SUPPORT

90. GENERAL. The NAILS program for the VOT is guided by Order 1800.58, NAILS Policy, dated July 2, 1987. NAILS is designed to ensure all applicable logistics element requirements are managed and integrated into all NAS programs. The current contract requires that the PM assess the impact of incorporating the NAILS element requirements into the project by an assessment of:

a. Supportability requirements.

b. Cost and schedule impact.

c. Cost versus life-cycle benefits.

d. Development/production/implementation phase of the subsystem.

e. Contractual limitation.

f. Operational requirements.

g. Maintenance concept.

h. Training.

91. MAINTENANCE CONCEPT. ANN-130 will provide for regional sparing of VOT Line Replaceable Units (LRU). Sparing is provided on a one for three basis to the sector level. Each AF sector that receives a new VOT will receive an onsite spares kit with the first system to be deployed to that sector. If a sector is to receive more than three VOT systems, an additional onsite spares kit will be shipped with the fourth system to be deployed to that sector. If desired, the sector may move the spares to a more convenient site after deployment. The AF workforce will identify a failed LRU, send it to the FAA Logistics Center, and obtain a spare from the closest spared site. The FAA Logistics Center will use CRS for l-3 years after deployment of the first operational site (one year with two one-year options). The region will replace spares at the spared site with repaired LRU's from the FAA Logistics Center. After CRS options expire, the repair technology will be transferred to the FAA Logistics Center.

92. TRAINING. A waiver to full NAILS (CCD N9657), which specifically included AF training, was granted on November 20, 1987. This decision was reversed after the DRR initial team meeting on August 8, 1989, because AF training is necessary to support personnel certification (Order 3400.3E, Airway Facilities Maintenance Personnel Certification Program). AHT-400 determined that a correspondence course with OJT would meet the AF training requirements. Accordingly, a correspondence course with OJT was developed by the contractor. Order 3400.3E stipulates two requirements: (1) system theory of operation, and (2) performance. System theory of operation training is provided by correspondence course #43716. A "bypass" examination was developed, but unless a technician is intimately familiar with the FA-10235 VOT equipment, this examination is not recommended. To meet the performance requirement, the correspondence course is followed by an OJT portion and a performance examination. Interim certification can be issued. once the performance examination is passed. A certification examination will be developed by the FAA Academy to replace the performance examination. The training requirements are outlined in subparagraphs a-d.

a. Air Traffic. No training required.

b. Airway Facilities Training.

(1) A two-part directed study course has been developed by the contractor with the assistance and approval of AAC-941A and AAC-943A. This two part course consists of approximately 35 hours independent study followed by 25 hours of supervised OJT. The correspondence course with OJT is #437 16. The prerequisites for #437 16 is #40276, Common Principals VORTAC.

(2) The contractor and the FAA Academy will provide supervised OJT training for the initial group of OJT instructors with course #48188. These OJT instructors will consist of a VOT maintenance technician from the first site in each sector to receive a VOT.

(3) This cadre of OJT instructors will conduct OJT training for the other maintenance technicians in their sector. The regional Training Program Management Officer (TPMO) will ensure that the OJT instructors meet all necessary training requirements.

c. F&E Training. The regional PM's will complete the correspondence course and be trained with the initial cadre of OJT instructors so that they can conduct planning and assist field installations.

d. Logistics Center Training. CRS are provided to support logistics center level repair for one year after first ORD, with options for two additional years. The contractor will provide supervised OJT training for one logistics center engineer and two technicians no later than 60 days before the end of the service contract. The FAA Logistics Center training course is a follow-on to the AF training course. The FAA Logistics Center personnel will have passed the correspondence course and OJT during the first class. The follow-on training will consist of OJT on the VOT test sets. These sets include special test fixtures, repair procedures, and the production acceptance tests for each LRU. A component-level repair

manual will be developed and validated during the CRS period for use by the FAA Logistics Center repair technicians.

93. SUPPORT TOOLS AND TEST EQUIPMENT. No new support tools or test equipment are required.

94. SUPPLY SUPPORT. The provisioning requirements for spare parts will be in accordance with FAA Specifications FAA-G- 12 1 Od, Provisioning Technical Documentation, and FAA-G- 1375b, Spare Parts-Peculiar for Electronic, Electrical and Mechanical Equipment. Also see paragraph 91, Maintenance Concept, for more details.

95. VENDOR DATA AND TECHNICAL MANUALS. Vendor data and technical manuals are provided under contract by CMC. Each site will be provided with a complete set of technical manuals.

96. DISPOSAL OF EXCESS EQUIPMENT. The existing obsolete VOT equipment shall be rendered excess and disposed of in accordance with Order 4800.2A.

97. FACILITIES. Site preparation shall be in accordance with section 9 of the TI manuals and Order 6810.2.

98. PACKAGING, HANDLING, STORAGE AND TRANSPORTATION (PHS&T). The PHS&T requirements for VOT are based on a deployment strategy of most systems being shipped directly to the site and the remainder to the FAA Logistics Center as F&E spares.

a. VOT components, equipment, and spares to include support equipment shipped directly to the site for immediate installation will be prepared for delivery in accordance with ASTM-D-395 l-82, Standard Practice for Commercial Packaging.

b. For shipment to the FAA Logistics Center, the following applies: All components and equipment, except spares, will be individually preserved/packaged Level A, and packed Level B in accordance with MIL-E-17555, Packaging of Electronic, Electrical Equipment, Accessories and Provisional Items (Repair Parts). Spares designated for FAA Logistics Center storage shall be preserved and packaged Level A, and packed Level C in accordance with MIL-E-17555.

c. All materials designated for FAA Logistics Center storage shall be marked in accordance with MIL-STD- 129, Marking for Shipment and Storage, and MIL-STD-1189, Bar Code Symbology.

d. VOT systems and spares shall be transported by the most economical means that are consistent with established Department of Transportation guidelines.

99. RESERVED.

APPENDIX 1. LIST OF FAA CONTACTS FOR VOT PROJECT

CONTRACT ADMINISTRATION

Contract Specialist	Willie Wilson (1) ALG-310	FTS 267-3674 (202) 267-3674
Contracting Officer	Clifford Bennett (1) ALG-310	FTS 267-3673 (202) 267-3673
Manager, Navigation and Landing Aids Branch	Abe Tenenbaum (1) ALG-310	FTS 267-3655 (202) 267-3655

PROGRAM MANAGEMENT

Program Manager for Navigation	Charles Ochoa (1) ANN-300	F T S 267-6601 (202) 267-6601

TECHNICAL ADMINISTRATION

Technical Officer	Calvin S. Miles (5) SEI	FTS 967-4895 (202) 646-4895
Associate Program Manager for Engineering, Navigation Program	John Williams (1) ANN-130	FTS 267-6552 (202) 267-6552
Division Manager for Navigation and Landing Engineering	Reuben Powell (1) ANN-100	FTS 267-6593 (202) 267-6593
Program Director for Navigation and Landing	Rodman Gill (1) ANN-l	FTS 267-6594 (202) 267-6594

TRAINING

Contract Officer Technical Representative	Judy Holcomb (6) AAC-943A	FTS 747-65 11 (405) 747-65 11
Training Specialist	Irene Baltierra (1) AAC-941A	FTS 747-3322 (405) 747-3322
Training Requirements	Tom Buschbaum (1) AHT-400	FTS 267-8030 (202) 267-8030

Maintenance Operations	Bob Hodges (1) ASM-260	FTS 267-3623 (202) 267-3623
QUALITY ASSURANCE		
Quality & Reliability Officer (QRO)	Bob Franklin (3) ALG-422	(516) 845-2210
Alternate QRO	John Dracopoulos (4) ALG-422	(516) 737-3626
MATERIAL MANAGEMENT		
Engineer, Material Repair	Jeri Monier (6) AAC-445A	FTS 747-5223 (405) 680-5223
Provisioner, Provisioning Spare Parts	LeRoy Tilford (6) AAC-485B	FTS 747-565 1 (405) 680-565 1
LOGISTICS		
Associate Program Manager for Logistics	Frances Wirtanen (1) ANS-420	FTS 267-5839 (202) 267-5839
GOVERNMENT PROPERTY ADMINISTRATION		
Supervisor, Transportation and Property Officer	Vacant (1) ALG-230	FTS 267-3587 (202) 267-3587
VOUCHER SUBMISSION/PAYMENT INFORMATION		
Manager, Accounts Payable Branch	Rufus Smith (1) AAA-220	FTS 267-8968 (202) 426-6756
SEI CONTRACTOR LIAISON		
Manager, Program Management	John McKinley (5) SEI	F T S 967-5804 (202) 646-5804
Technical Officer (COTR)	Calvin S. Miles (5) SEI	FTS 967-4895 (202) 646-4895
Liaison Agreement	Nick Cantwell (5) SEI	F T S 967-2380 (202) 646-2380

Finance	Jeff Pearson (5) SEI	FTS 967-5832 (202) 646-5832
Training	Louis Armijo (5) SEI	FTS 967-5427 (202) 646-5427
Logistics	Dick LaFrance (5) SEI	FTS 967-5877 (202) 646-5877

NOTE: Numbers in parenthesis designate respective mailing addresses which are listed below.

Mailing Addresses .

(1) Federal Aviation Administration
800 Independence Avenue S.W.
Washington, DC 2059 1

(2) Canadian Marconi Company
415 Legget Drive
Box 13330
Kanata, Ontario
Canada K2K 2B2

(3) Bob Franklin
Norden Systems
Attn: FAA QRO
75 Maxess Road
Melville, NY 11747 .

(4) John B. Dracopoulos
ALG-422, Room 30
4175 Veterans Hwy
. Ronkonkoma, NY 11779

(5) Martin Marietta
475 School Street S.W.
WDC-v43
Washington, DC 20024

(6) Federal Aviation Administration
Mike Monroney Aeronautical Center
P.O. Box 25082
Oklahoma City, OK 73125

APPENDIX 2. LIST OF APPLICABLE DOCUMENTS

ORDER 1320.1C	FAA DIRECTIVES SYSTEM
ORDER 1800.58	NATIONAL AIRSPACE INTEGRATED LOGISTICS SUPPORT (NAILS) POLICY
ORDER 1800.8E	NATIONAL AIRSPACE SYSTEM CONFIGURATION MANAGEMENT
ORDER 1810.4A	NAS TEST AND EVALUATION PROGRAM
ORDER 3400.3E	AIRWAY FACILITIES MAINTENANCE PERSONNEL CERTIFICATION PROGRAM
ORDER 4800.2A	UTILIZATION AND DISPOSAL OF EXCESS AND SURPLUS PERSONAL PROPERTY
ORDER 6030.45	FACILITY REFERENCE DATA FILES
ORDER 6810.2	VHF OMNIRANGE TEST (VOT) SITING CRITERIA
ORDER OA P 8200.1	UNITED STATES STANDARD FLIGHT INSPECTION MANUAL
FAA-STD-019	GROUNDING, BONDING AND SHIELDING
FAA-STD-028A	CONTRACT TRAINING PROGRAMS
FAA-STD.036	PREPARATION OF PROJECT IMPLEMENTATION PLANS
FAA-G-1210D	PROVISIONING TECHNICAL DOCUMENTATION
FAA-G-1375B	SPARE PARTS-PECULIAR FOR ELECTRONIC, ELECTRICAL AND MECHANICAL EQUIPMENT
ASTM-D-3951-82	STANDARD PRACTICE FOR COMMERCIAL PACKAGING
MIL-STD.129	MARKING FOR SHIPMENT AND STORAGE
MIL-STD-1189	BAR CODE SYMBOLOGY
MIL-STD-17555	PACKAGING OF ELECTRONIC, ELECTRICAL EQUIPMENT, ACCESSORIES AND PROVISIONAL ITEMS (REPAIR PARTS)

NAS-SS-1000	FUNCTIONAL AND PERFORMANCE REQUIREMENTS FOR THE NATIONAL AIRSPACE SYSTEM
VOLUME I	GENERAL
VOLUME III	MAINTENANCE AND OPERATIONS SUPPORT ELEMENT
FAA-E-2768	VHF OMNIRANGE TEST (VOT) FACILITY
TI-6810.1	VHF OMNIRANGE TEST (VOT) FACILITY

APPENDIX 3. VOT SITE LISTING
REVISION I, 5/23/91

	LOCATION	STATE	ID	REGION	TYPE	DEL	ORD	FREQ.	SECTOR	SPARE
					E=ESTABLISH R=REPLACE T=TEST					
1	OKLAHOMA CITY (ASM-640)	OK			T	12/90		111.00		1/1
2	HONOLULU	HI	HNL	AWP	R	2/91	4/91	111.00	HONOLULU	1/1
3	OKLAHOMA CITY (AAC-445)	OK			T	3/91		113.00		1/1
4	OKLAHOMA CITY (AAC-480)	OK				3/91		113.00		1/3
5	OKLAHOMA CITY (AAC-480)	OK				3/91		111.00		2/3
6	OKLAHOMA CITY (AAC-480)	OK				3/91		109.00		3/3
7	SAN PEDRO	CA	QSO	AWP	R	5/91	8/91	113.90	SAN DIEGO	1/2
8	BAKERSFIELD	CA	BFL	AWP	E	5/91	8/91	111.20	SACRAMENTO	1/1
9	WEST PALM BEACH	FL	PBI	AS0	R	5/91	8/91	109.00	MIAMI	1/1
10	HOUSTON	TX	HUB	ASW	R	5/91	8/91	111.60	HOUSTON	1/1
11	BURLINGTON	VT	BTV	ANE	R	5/91	8/91	109.00	WINDSOR LOCKS	1/1
12	ALBUQUERQUE	NM	ABQ	ASW	R	6/91	9/91	111.00	ALBUQUERQUE	1/1
13	ST.LOUIS	MO	STL	ACE	R	6/91	9/91	111.00	ST LOUIS	1/2
14	LAGUARDIA (FLUSHING)	NY	LGA	AEA	R	6/91	9/91	109.00	METRO	
15	DENVER (STAPLETON INTL)	CO	DEN	ANM	R	6/91	9/91	110.00	DENVER	1/1
16	JACKSON	MS	JAN	ASO	E	6/91	9/91	111.00	JACKSON	1/1
17	EL CAJON	CA	SEE	AWP	R	6/91	9/91	110.00	SAN DIEGO	
18	JUNEAU	AK	JNU	AAL	E	7/91	10/91	111.00	ANCHORAGE	1/2
19	JOHN F. KENNEDY	NY	JFK	AEA	R	7/91	10/91	115.10	METRO	1/1
20	SAN ANTONIO	TX	SAT	ASW	R	7/91	10/91	110.40	SAN ANTONIO	1/1
21	KANSAS CITY (DOWNTOWN)	MO	MKC	ACE	R	8/91	11/91	108.60	ST LOUIS	
22	CMC TESTBED (AAC-480)	OK				3/93		112.00		
23	PHOENIX	AZ	PHX	AWP	R	8/91	11/91	109.00	PHOENIX	1/1
24	HUNTSVILLE	AL	HSV	ASO	E	8/91	11/91	111.00	MEMPHIS	1/2
25	PORTLAND	OR	PDX	ANM	R	8/91	11/91	111.00	PORTLAND	1/2
26	PORTLAND	ME	PWM	ANE	E	8/91	11/91	112.10	BANGOR	1/1
27	CHICAGO O'HARE	IL	ORD	AGL	R	8/91	11/91	112.00	CHICAGO	1/1
28	DAYTONA BEACH	FL	DAB	AS0	E	8/91	11/91	111.00	JACKSONVILLE	1/1
29	HICKORY	NC	HKY	AS0	E	8/91	11/91	110.00	CHARLOTTE	1/1
30	KETCHIKAN	AK	KTN	AAL	E	8/91	11/91	111.00	ANCHORAGE	
31	SPOKANE	WA	GEG	ANM	R	8/91	11/91	109.60	SEATTLE	1/2
32	BUFFALO	NY	BUF	AEA	R	8/91	11/91	109.00	EMPIRE (SYRACUSE)	1/1
33	SEATTLE BOEING FIELD	WA	BFI	ANM	R	9/91	12/91	108.60	SEATTLE	
34	DETROIT WILLOW RUN	MI	YIP	AGL	E	9/91	11/91	112.00	BELLEVILLE	1/1
35	VERO BEACH	FL	VRB	ASO	E	9/91	12/91	111.00	TAMPA	1/1
36	CHICAGO MIDWAY	IL	MDW	AGL	R	9/91	12/91	111.00	CHICAGO	
37	DETROIT CITY	MI	DET	AGL	R	9/91	12/91	111.60	BELLEVILLE	
38	LAKEFRONT (NEW ORLEANS)	LA	NEW	ASW	R	9/91	12/91	111.00	NEW ORLEANS	1/1

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	LOCATION	STATE	ID	REGION	TYPE	DEL	ORD	FREQ.	SECTOR	SPARE
					E=ESTABLISH R=REPLACE T=TEST					
39	SMYRNA	TN	MQY	AS0	E	9/91	12/91	110.20	MEMPHIS	
40	SITKA	AK	SIT	AAL	E	9/91	12/91	111.00	ANCHORAGE	
41	LAS VEGAS	NV	LAS	AWP	E	9/91	12/91	108.20	LAS VEGAS	1/1
42	OKLAHOMA CITY	OK	OKC	ASW	R	9/91	12/91	108.80	OKLAHOMA CITY	1/1
43	SALT LAKE CITY	UT	SLC	ANM	R	9/91	12/91	111.00	SALT LAKE CITY	1/1
44	WASHINGTON NATIONAL	DC	DCA	AEA	R	9/91	1/92	109.40	CAPITOL	1/1
45	ST. PAUL	MN	STP	AGL	E	10/91	1/92	114.40	MINNEAPOLIS	1/1
46	CHESTERFIELD	MO	sus	ACE	E	10/91	1/92	112.20	ST LOUIS	
47	WINDSOR LOCKS	CT	BDL	ANE	E	10/91	1/92	111.40	WINDSOR LOCKS	
48	NEWARK	NJ	EWR	AEA	R	10/91	1/92	110.00	TRISTATE (TRENTON)	
49	BOSTON (LOGAN)	MA	BOS	ANE	R	10/91	1/92	111.00	BOSTON	I/S.
50	TULSA	OK	TUL	ASW	R	10/91	1/92	109.00	OKLAHOMA CITY	
51	HILLSBORO	OR	HIO	ANM	E	10/91	1/92	115.20	PORTLAND	
52	SACRAMENTO (METROPOLITAN)	CA	SMF	AWP	E	10/91	1/92	111.40	SACRAMENTO	
53	MEDFORD	OR	MFR	ANM	R	10/91	1/92	117.20	PORTLAND	
54	PHILADELPHIA	PA	PHL	AEA	R	10/91	1/92	109.80	TRISTATE (TRENTON)	1/1
55	CLEVELAND HOPKINS	OH	CLE	AGL	R	10/91	1/92	110.40	CLEVELAND	1/2
56	DALLAS (LOVE FIELD)	TX	DAL	ASW	R	10/91	1/92	113.80	DALLAS/FT WORTH	1/1
57	DAVENPORT	IA	DVN	ACE	E	11/91	2/92	111.80	DES MOINES	
58	LOS ANGELES	CA	LAX	AWP	E	11/91	2/92	113.90	LOS ANGELES	1/1
59	DES MOINES	IA	DSM	ACE	E	11/91	2/92	109.20	DES MOINES	1/1
60	SAN FRANCISCO	CA	SFO	AWP	R	11/91	2/92	111.00	HAYWARD	1/1
61	ANDREWS AFB	MD	ADW	AEA	R	11/91	2/92	109.60	SUITLAND	
62	ALBANY	NY	ALB	AEA	R	11/91	2/92	109.00	EMPIRE (SYRACUSE)	
63	JEFFERSON CITY	MO	JEF	ACE	E	11/91	2/92	112.00	ST LOUIS	2/2
64	OMAHA	NE	OMA	ACE	E	11/91	2/92	109.00	GRAND ISLAND	1/1
65	BOISE	ID	BOI	ANM	E	11/91	2/92	116.70	PORTLAND	2/2
66	MILWAUKEE	WI	MKE	AGL	R	11/91	2/92	109.00	GREEN BAY	1/1
67	EL PASO	TX	ELP	ASW	R	11/91	2/92	111.00	EL PASO	1/1
68	SACRAMENTO (EXECUTIVE)	CA	SAC	AWP	E	11/91	2/92	111.40	SACRAMENTO	
69	SPOKANE FELTS FIELD	WA	SFF	ANM	E	12/91	3/92	114.00	SEATTLE	
70	WICHITA	KS	ICT	ACE	E	12/91	3/92	114.00	WICHITA	l/l
71	COLORADO SPRINGS	co	cos	ANM	E	12/91	3/92	116.30	DENVER	
72	BRUNSWICK	GA	BQK	AS0	E	12/91	3/92	111.00	COLUMBIA	1/1
73	CINCINNATI LUKEN	OH	LUK	AGL	R	12/91	3/92	108.40	CLEVELAND	
74	BEDFORD (HANSCOM)	MA	BED	ANE	R	12/91	3/92	110.00	BOSTON	
75	SEATTLE	WA	SEA	ANM	E	12/91	3/92	117.50	SEATTLE	2/2

APPENDIX 3. VOT SITE LISTING
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	LOCATION	STATE	ID	REGION	TYPE	DEL	ORD	FREQ.	SECTOR	SPARE
					E=ESTABLISH R=REPLACE T=TEST					
76	SHREVEPORT	LA	SHV	ASW	E	12/91	3/92	108.20	LITTLE ROCK	1/1
77	ATLANTA	GA	ATL	AS0	R	12/91	3/92	111.00	ATLANTA	1/1
78	MIDLAND	TX	MAF	ASW	E	12/91	3/92	108.20	AUSTIN	1/1
79	FORT WORTH	TX	FTW	ASW	R	12/91	3/92	108.20	DALLAS/FT WORTH	
80	BIRMINGHAM	AL	BHM	AS0	R	12/91	3/92	110.00	MONTGOMERY	1/1
81	ANCHORAGE	AK	ANC	AAL	R	1/92	4/92	111.00	ANCHORAGE	2/2
82	CHARLESTON	WV	CRW	AEA	R	1/92	4/92	108.80	CHARLESTON	1/1
83	COLUMBUS INTN	OH	CMH	AGL	R	1/92	4/92	111.00	CLEVELAND	2/2
84	SAN DIEGO	CA	SAN	AWP	R	1/92	4/92	109.00	SAN DIEGO	2/2
85	CHARLESTON	SC	CHS	AS0	R	1/92	4/92	111.00	COLUMBIA	
86	DAYTON INTN	OH	DAY	AGL	R	1/92	4/92	111.00	CLEVELAND	
87	CHARLOTTE	NC	CLT	AS0	R	1/92	4/92	112.00	CHARLOTTE	
88	AKRON-CANTON	OH	CAK	AGL	R	1/92	4/92	110.60	CLEVELAND	
89	JACKSONVILLE	FL	JAX	AS0	R	1/92	4/92	111.00	JACKSONVILLE	
90	FORT WAYNE	IN	FWA	AGL	R	1/92	4/92	111.00	INDIANAPOLIS	1/1
91	TUCSON	AZ	TUS	AWP	E	1/92	4/92	109.80	PHOENIX	
92	KNOXVILLE	TN	TYS	AS0	R	1/92	4/92	112.00	COVINGTON	1/1
93	MINNEAPOLIS	MN	MSP	AGL	R	2/92	5/92	111.00	MINNEAPOLIS	
94	LOUISVILLE	KY	SDF	AS0	R	2/92	5/92	111.00	COVINGTON	
95	MEMPHIS	TN	MEM	AS0	R	2/92	5/92	111.00	MEMPHIS	
96	MIAMI	FL	MIA	AS0	R	2/92	5/92	112.00	MIAMI	
97	INDIANAPOLIS	IN	IND	AGL	R	2/92	5/92	111.80	INDIANAPOLIS	
98	NASHVILLE	TN	BNA	AS0	R	2/92	5/92	111.00	MEMPHIS	2/2
99	SAVANNAH	GA	SAV	AS0	R	2/92	5/92	111.00	COLUMBIA	
100	TALLAHASSEE	FL	TLH	AS0	R	2/92	5/92	111.00	JACKSONVILLE	
101	TAMPA	FL	TPA	AS0	R	2/92	5/92	111.00	TAMPA	
102	HARRISBURG	!?A	HAR	AEA	E	2/92	5/92	108.00	HARRISBURG	1/1
103	DETROIT	MI	DTW	AGL	R	2/92	5/92	109.80	BELLEVILLE	
104	SANTA ANA	CA	SNA	AWP	E	2/92	5/92	110.00	SAN DIEGO	
105	DENVER CENTENNIAL	CO	APA	ANM	E	3/92	6/92	117.40	DENVER	
106	TOPEKA (FORBES FIELD)	KS	FOE	ACE	E	3/92	6/92	111.00	WICHITA	
107	MacARTHUR (ISLIP)	NY	ISL	AEA	E	3/92			METRO	2/2
108	OKLAHOMA CITY (AAC-480)	OK				3/92		110.00		
109	OKLAHOMA CITY (AAC-480)	OK				3/92		110.00		
110	OKLAHOMA CITY (AAC-480)	OK				3/92		108.00		
111	OKLAHOMA CITY (AAC-480)	OK				3/92		111.00		
112	OKLAHOMA CITY (AAC-480)	OK				3/92		113.90		

APPENDIX 4. LIST OF ACRONYMS

AAC	-	Mike Monroney Aeronautical Center
AC		Alternating Current
ACN	-	Engineering, Test and Evaluation Service
Al?	-	Airway Facilities
AHT	-	Airway Facilities Training and Higher Education
ALG	-	Logistics Services
ANN	-	Program Director for Navigation and Landing
ANS	-	NAS Transition and Implementation Service
APML	-	Associate Program Manager for Logistics
ASM	-	Systems Maintenance Service
ATCT	-	Airport Traffic Control Tower
ATE	-	Automated Test Equipment
ATR	-	Air Traffic Plans and Requirements Service
CCB	-	Configuration Control Board
CCD	-	Configuration Control Decision
CDI	-	Course Deviation Indicator
CMC	-	Canadian Marconi Company
CO	-	Contracting Officer
COTR	-	Contracting Officer's Technical Representative
CRS	-	Contractor Repair Services
dB		Decibel
DRR	-	Deployment Readiness Review

ECP	-	Engineering Change Proposal
ESS	-	Environmental Stress Screening
FAA	-	Federal Aviation Administration
F&E	-	Facilities and Equipment
FSS	-	Flight Service Station
HZ	-	Hertz
ILS	-	Instrument Landing System
IOC	-	Initial Operational Capability
JAI	-	Joint Acceptance Inspection
kHz	-	Kilohertz
LED	-	Light Emitting Diode
LRU	-	Line Replaceable Unit
MHz	-	Megahertz
NAILS	-	National Airspace Integrated Logistics Support
NAILSMT	-	NAILS Management Team
NAS	-	National Airspace System
NAVAID	-	Navigational Aid
OJT	-	On-the-Job Training
ORD	-	Operational Readiness Date
OT&E	-	Operational Test and Evaluation
PA	-	Purchase Authorization
PCB&T	-	Personnel, Compensation, Benefits, and Travel
PDSR	-	Program Director Status Review
PM	-	Project Manager

POM	-	Program Overview' Meeting
QRO	-	Quality Reliability Officer
RCAG	-	Remote Center Air-to-Ground
RF	-	Radiofrequency
RIG	-	Regional Integration Group
RSCU	-	Remote Status and Control Unit
RTR	-	Remote Transmitter/Receiver
SEI	-	System Engineering and Integration
SIP	-	System Implementation Plan
SMO	-	Spectrum Management Officer
SPP	-	System Program Plan
T&E	-	Test and Evaluation
TD	-	Test Director
T I	-	Technical Instruction (Manual)
TIM	-	Technical Interchange Meeting
TO	-	Technical Officer
TPMO	-	Training Program Management Officer
UL	-	Underwriters' Laboratories
VHF	-	Very High Frequency
VOR	-	VHF Omnidirectional Range
VOT	-	VHF Omnidirectional Range Test
W	-	Watts

RECORD OF CHANGES

DIRECTIVE NO.

CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE	CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE

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GPO : 1968 OF-308-383